



Client **Samsung (Dymstec)**

CALIBRATION CERTIFICATE			
Object(s)	ET3DV6 - SN:1551		
Calibration procedure(s)	QA CAL-01.v2 Calibration procedure for dosimetric E-field probes		
Calibration date:	August 28, 2003		
Condition of the calibrated item	In Tolerance (according to the specific calibration document)		
<p>This calibration statement documents traceability of M&amp;TE used in the calibration procedures and conformity of the procedures with the ISO/IEC 17025 international standard.</p> <p>All calibrations have been conducted in the closed laboratory facility: environment temperature 22 +/- 2 degrees Celsius and humidity &lt; 75%.</p>			
Calibration Equipment used (M&TE critical for calibration)			
Model Type	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
RF generator HP 8684C	US3642U01700	4-Aug-99 (SPEAG, in house check Aug-02)	In house check: Aug-05
Power sensor E4412A	MY41495277	2-Apr-03 (METAS, No 252-0250)	Apr-04
Power sensor HP 8481A	MY41092180	18-Sep-02 (Agilent, No. 20020918)	Sep-03
Power meter EPM E4419B	GB41293874	2-Apr-03 (METAS, No 252-0250)	Apr-04
Network Analyzer HP 8753E	US37390585	18-Oct-01 (Agilent, No. 24BR1033101)	In house check: Oct 03
Fluke Process Calibrator Type 702	SN: 6295803	3-Sep-01 (ELCAL, No.2360)	Sep-03
Calibrated by:	Name Nico Welter	Function Technician	Signature 
Approved by:	Name Katja Pokovic	Function Laboratory Director	Signature 
			Date issued: August 28, 2003
<p>This calibration certificate is issued as an intermediate solution until the accreditation process (based on ISO/IEC 17025 International Standard) for Calibration Laboratory of Schmid &amp; Partner Engineering AG is completed.</p>			

# Probe ET3DV6

**SN:1551**

Manufactured:       October 16, 2000  
Last calibration:    May 22, 2003  
Recalibrated:        August 28, 2003

**Calibrated for DASY Systems**

(Note: non-compatible with DASY2 system!)

## DASY - Parameters of Probe: ET3DV6 SN:1551

### Sensitivity in Free Space

NormX	<b>1.50</b> $\mu\text{V}/(\text{V}/\text{m})^2$
NormY	<b>1.54</b> $\mu\text{V}/(\text{V}/\text{m})^2$
NormZ	<b>1.43</b> $\mu\text{V}/(\text{V}/\text{m})^2$

### Diode Compression

DCP X	<b>94</b>	mV
DCP Y	<b>94</b>	mV
DCP Z	<b>94</b>	mV

### Sensitivity in Tissue Simulating Liquid

Head                      900 MHz                       $\epsilon_r = 41.5 \pm 5\%$                        $\sigma = 0.97 \pm 5\%$  mho/m

Valid for f=800-1000 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	<b>6.7</b> $\pm 9.5\%$ (k=2)	Boundary effect:
ConvF Y	<b>6.7</b> $\pm 9.5\%$ (k=2)	Alpha <b>0.27</b>
ConvF Z	<b>6.7</b> $\pm 9.5\%$ (k=2)	Depth <b>3.11</b>

Head                      1800 MHz                       $\epsilon_r = 40.0 \pm 5\%$                        $\sigma = 1.40 \pm 5\%$  mho/m

Valid for f=1710-1910 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	<b>5.4</b> $\pm 9.5\%$ (k=2)	Boundary effect:
ConvF Y	<b>5.4</b> $\pm 9.5\%$ (k=2)	Alpha <b>0.45</b>
ConvF Z	<b>5.4</b> $\pm 9.5\%$ (k=2)	Depth <b>2.77</b>

### Boundary Effect

Head                      900 MHz                      Typical SAR gradient: 5 % per mm

Probe Tip to Boundary		<b>1 mm</b>	<b>2 mm</b>
SAR <sub>be</sub> [%]	Without Correction Algorithm	9.5	5.9
SAR <sub>be</sub> [%]	With Correction Algorithm	0.4	0.5

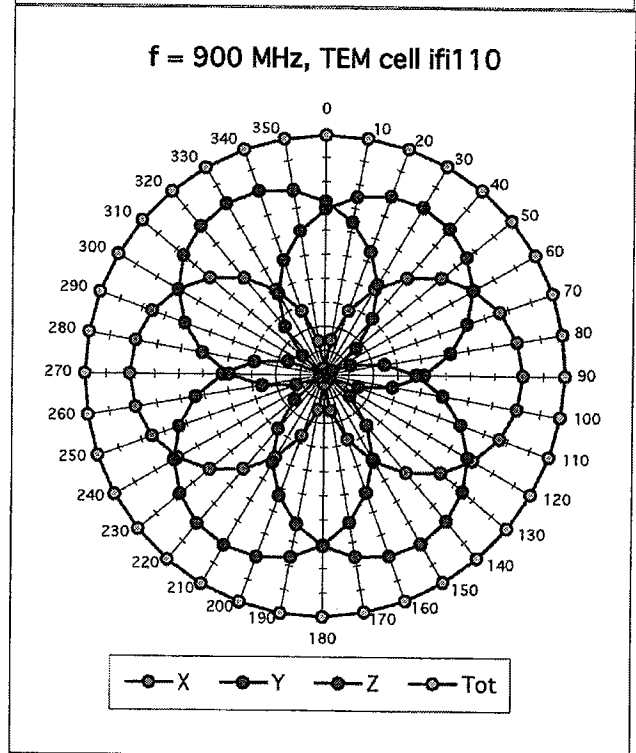
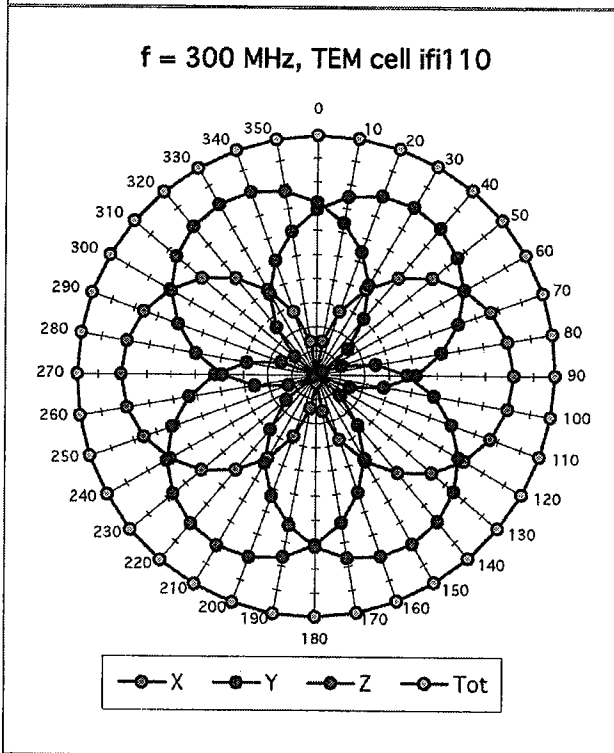
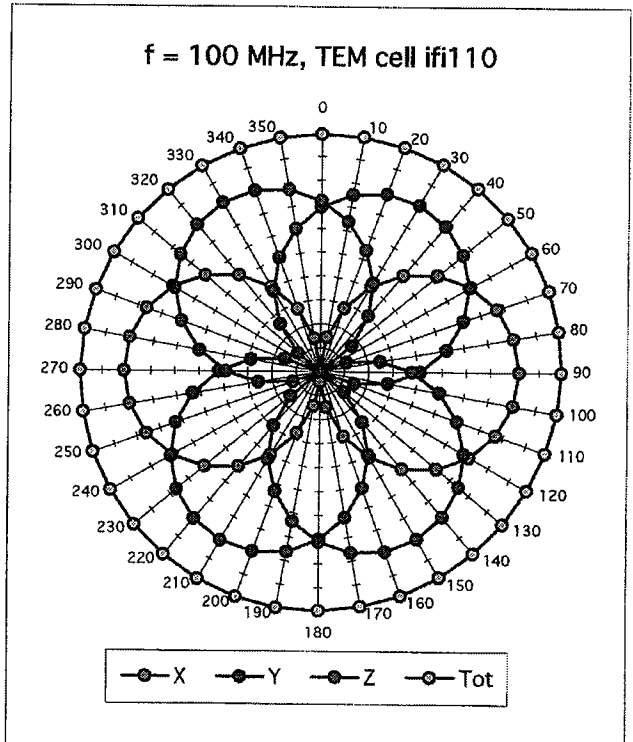
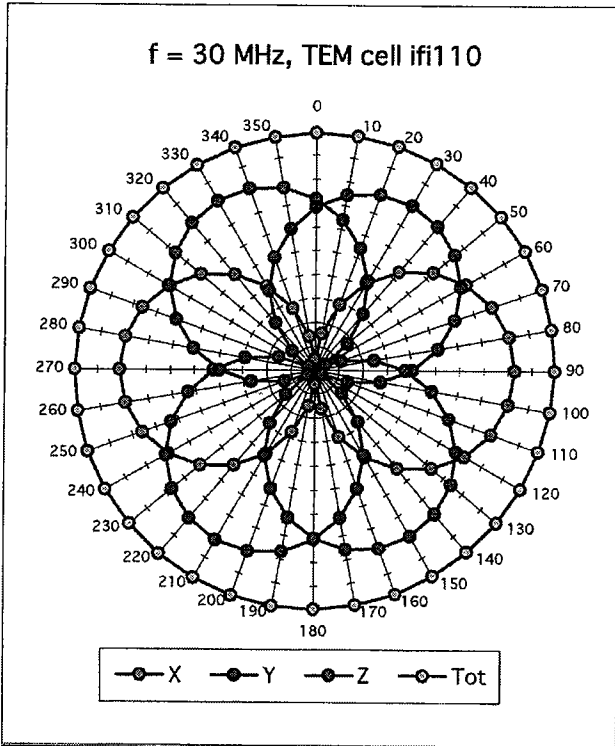
Head                      1800 MHz                      Typical SAR gradient: 10 % per mm

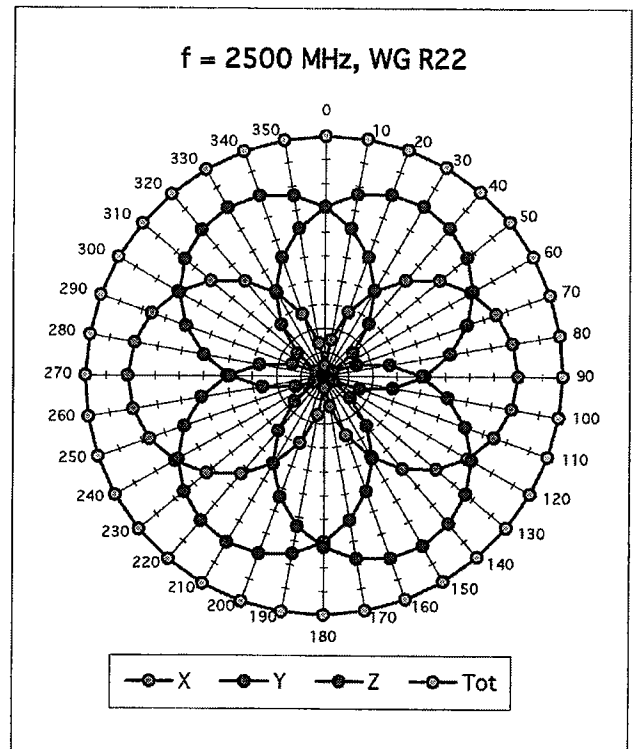
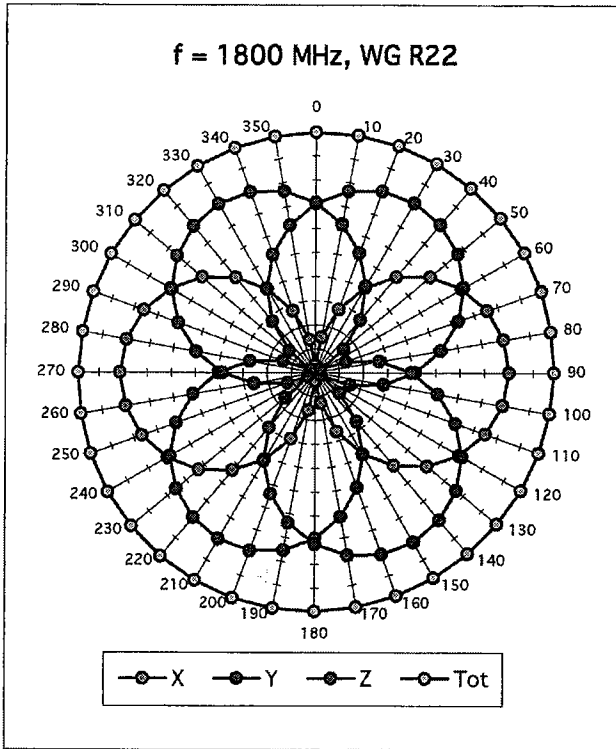
Probe Tip to Boundary		<b>1 mm</b>	<b>2 mm</b>
SAR <sub>be</sub> [%]	Without Correction Algorithm	13.1	9.0
SAR <sub>be</sub> [%]	With Correction Algorithm	0.2	0.1

### Sensor Offset

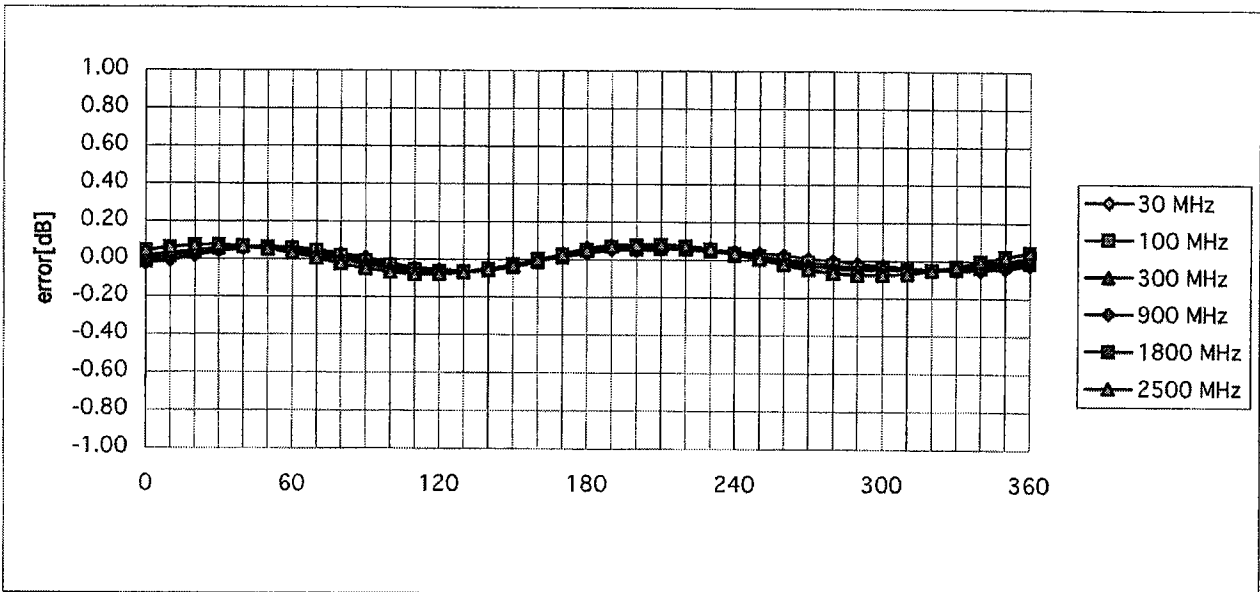
Probe Tip to Sensor Center	<b>2.7</b>	mm
Optical Surface Detection	<b>1.6 <math>\pm</math> 0.2</b>	mm

### Receiving Pattern ( $\phi$ ), $\theta = 0^\circ$



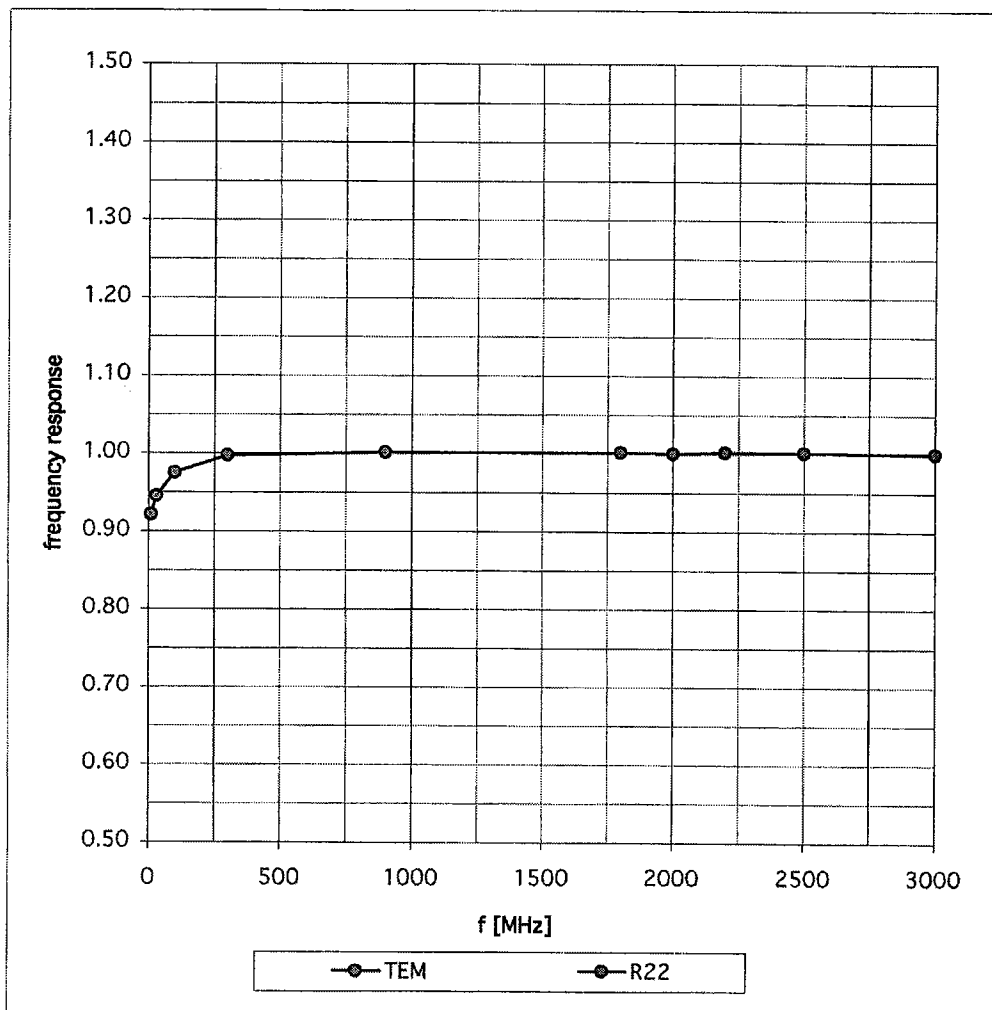


### Isotropy Error ( $\phi$ ), $\theta = 0^\circ$



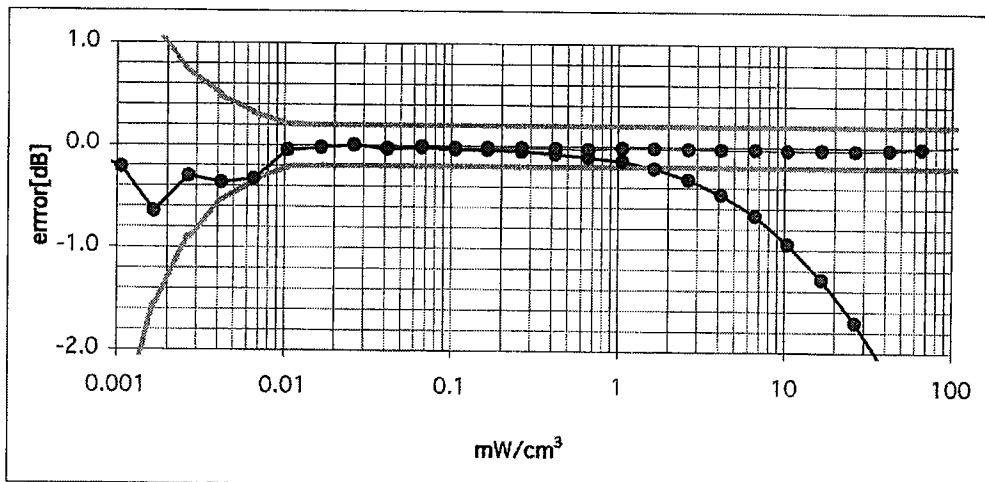
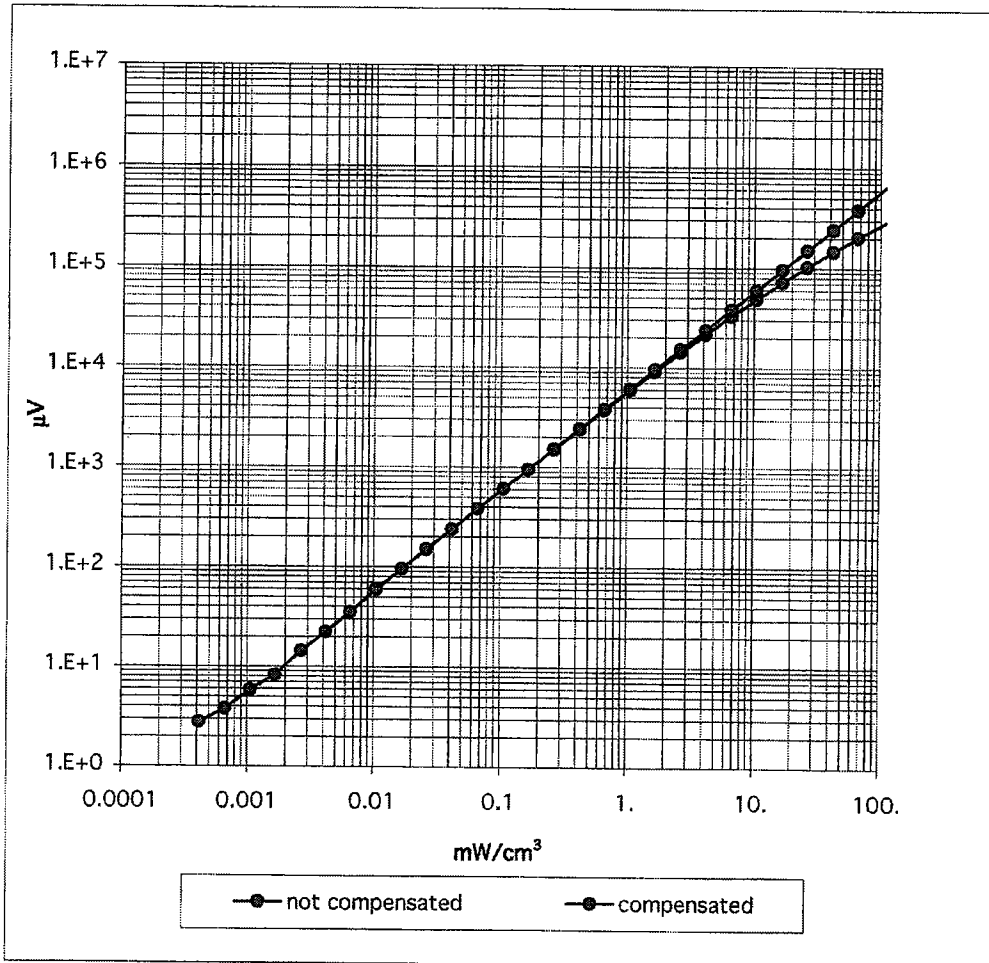
# Frequency Response of E-Field

( TEM-Cell:if1110, Waveguide R22)

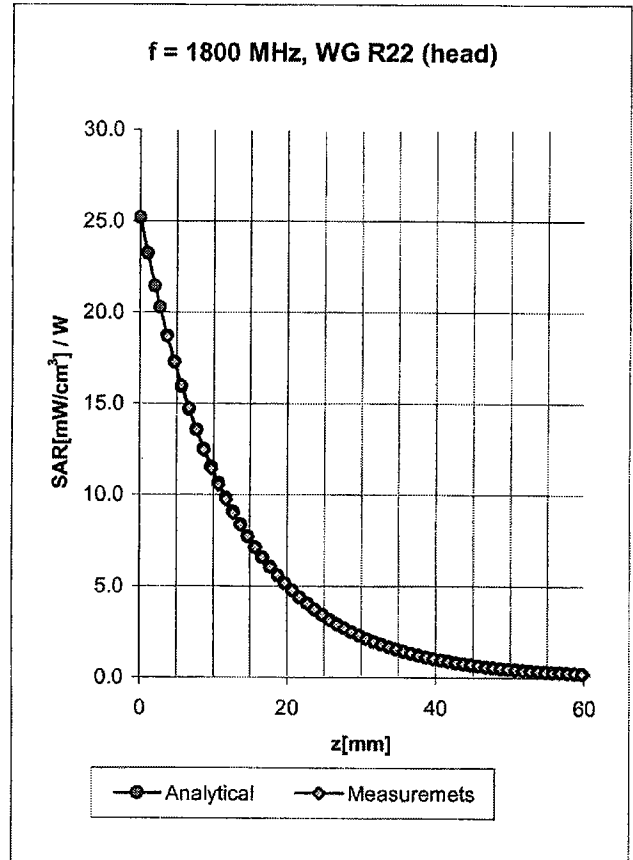
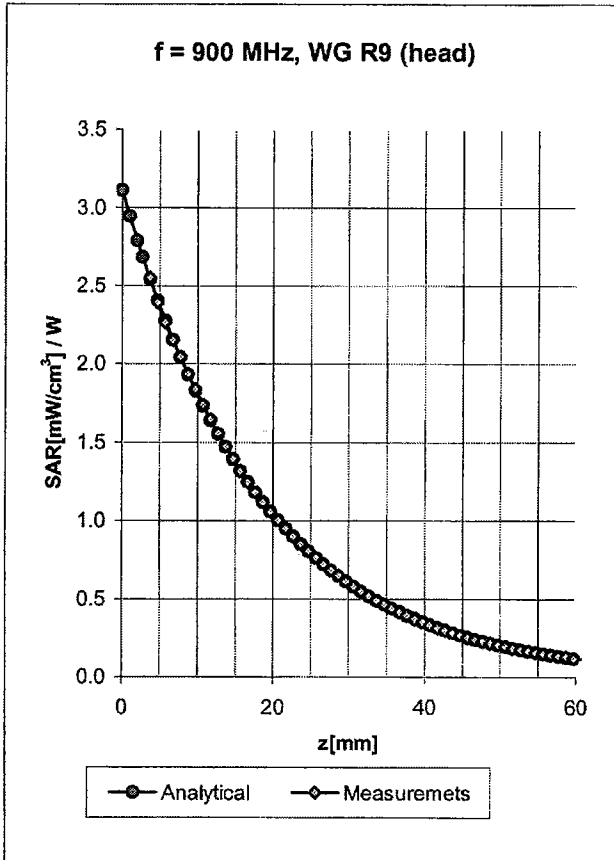


### Dynamic Range f(SARhead)

( Waveguide R22 )



### Conversion Factor Assessment



Head                      900 MHz                       $\epsilon_r = 41.5 \pm 5\%$                        $\sigma = 0.97 \pm 5\%$  mho/m

Valid for f=800-1000 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

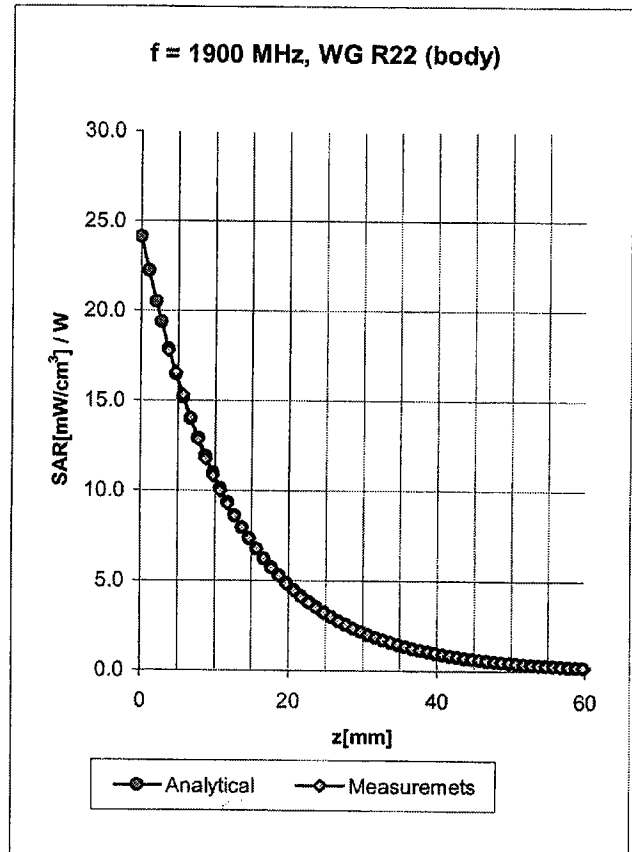
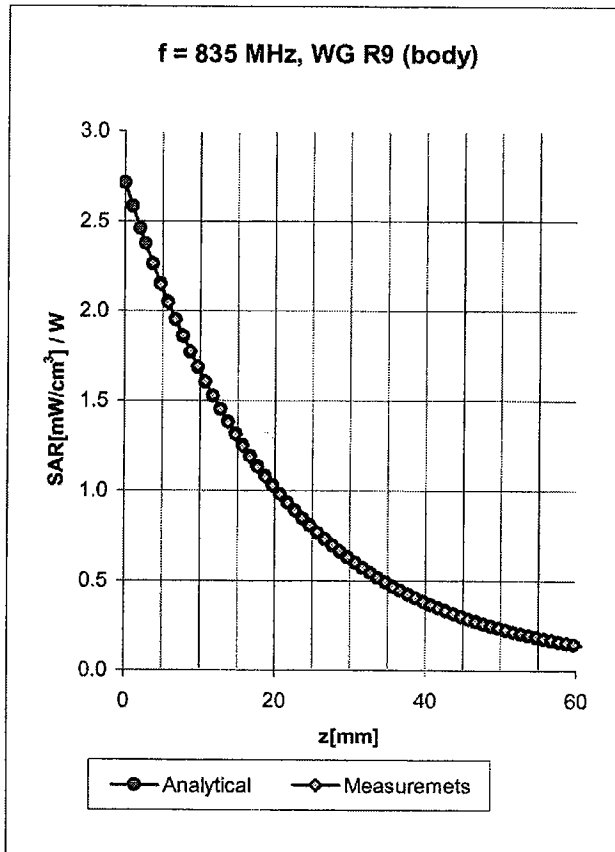
ConvF X	<b>6.7</b> $\pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	<b>6.7</b> $\pm 9.5\%$ (k=2)	Alpha	<b>0.27</b>
ConvF Z	<b>6.7</b> $\pm 9.5\%$ (k=2)	Depth	<b>3.11</b>

Head                      1800 MHz                       $\epsilon_r = 40.0 \pm 5\%$                        $\sigma = 1.40 \pm 5\%$  mho/m

Valid for f=1710-1910 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	<b>5.4</b> $\pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	<b>5.4</b> $\pm 9.5\%$ (k=2)	Alpha	<b>0.45</b>
ConvF Z	<b>5.4</b> $\pm 9.5\%$ (k=2)	Depth	<b>2.77</b>

### Conversion Factor Assessment



Body                      835 MHz                       $\epsilon_r = 55.2 \pm 5\%$                        $\sigma = 0.97 \pm 5\%$  mho/m

Valid for f=750-950 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	<b>6.9</b> $\pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	<b>6.9</b> $\pm 9.5\%$ (k=2)	Alpha	<b>0.37</b>
ConvF Z	<b>6.9</b> $\pm 9.5\%$ (k=2)	Depth	<b>2.46</b>

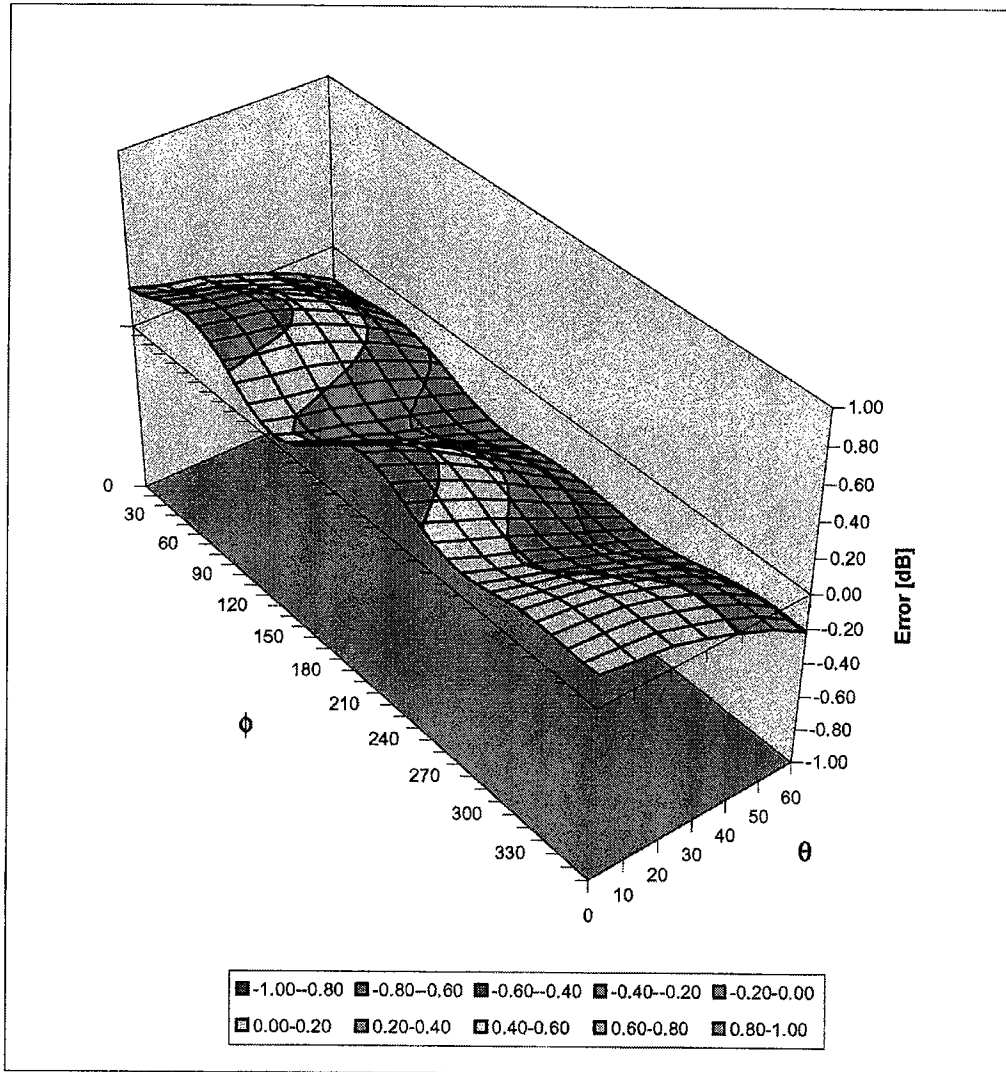
Body                      1900 MHz                       $\epsilon_r = 53.3 \pm 5\%$                        $\sigma = 1.52 \pm 5\%$  mho/m

Valid for f=1800-2000 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	<b>4.8</b> $\pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	<b>4.8</b> $\pm 9.5\%$ (k=2)	Alpha	<b>0.57</b>
ConvF Z	<b>4.8</b> $\pm 9.5\%$ (k=2)	Depth	<b>2.70</b>

# Deviation from Isotropy in HSL

Error ( $\theta, \phi$ ),  $f = 900$  MHz



Client **Samsung (Dymstec)**

**CALIBRATION CERTIFICATE**

Object(s) **ET6DV6 - SN 1617**

Calibration procedure(s) **QA CAL-01 v2  
 Calibration procedure for dosimetric E-field probes**

Calibration date: **September 18, 2003**



Condition of the calibrated item **In Tolerance (according to the specific calibration document)**

This calibration statement documents traceability of M&TE used in the calibration procedures and conformity of the procedures with the ISO/IEC 17025 international standard.

All calibrations have been conducted in the closed laboratory facility: environment temperature 22 +/- 2 degrees Celsius and humidity < 75%.

Calibration Equipment used (M&TE critical for calibration)

Model Type	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM E4419B	GB41293874	2-Apr-03 (METAS, No 252-0250)	Apr-04
Power sensor E4412A	MY41495277	2-Apr-03 (METAS, No 252-0250)	Apr-04
Reference 20 dB Attenuator	SN: 5086 (20b)	3-Apr-03 (METAS No. 251-0340)	Apr-04
Fluke Process Calibrator Type 702	SN: 6295803	8-Sep-03 (Sintrel SCS No. E-030020)	Sep-04
Power sensor HP 8481A	MY41092180	18-Sep-02 (Agilent, No. 20020918)	In house check: Oct 03
RF generator HP 8684C	US3642U01700	4-Aug-99 (SPEAG, in house check Aug-02)	In house check: Aug-05
Network Analyzer HP 8753E	US37390585	18-Oct-01 (Agilent, No. 24BR1033101)	In house check: Oct 03

	Name	Function	Signature
Calibrated by:	Katja Pokovic	Laboratory Director	
Approved by:	Fin Bortholt	R&D Director	

Date issued: September 18, 2003

This calibration certificate is issued as an intermediate solution until the accreditation process (based on ISO/IEC 17025 international Standard) for Calibration Laboratory of Schmid & Partner Engineering AG is completed.

# Probe ET3DV6

**SN:1617**

Manufactured: January 25, 2002  
Last calibration: July 16, 2002  
Recalibrated: September 18, 2003

**Calibrated for DASYS Systems**

(Note: non-compatible with DASYS2 system!)

## DASY - Parameters of Probe: ET3DV6 SN:1617

### Sensitivity in Free Space

NormX	<b>1.78</b> $\mu\text{V}/(\text{V}/\text{m})^2$
NormY	<b>1.75</b> $\mu\text{V}/(\text{V}/\text{m})^2$
NormZ	<b>1.79</b> $\mu\text{V}/(\text{V}/\text{m})^2$

### Diode Compression

DCP X	<b>96</b>	mV
DCP Y	<b>96</b>	mV
DCP Z	<b>96</b>	mV

### Sensitivity in Tissue Simulating Liquid

Head                      900 MHz                       $\epsilon_r = 41.5 \pm 5\%$                        $\sigma = 0.97 \pm 5\%$  mho/m

Valid for f=800-1000 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	<b>6.3</b> $\pm 9.5\%$ (k=2)	Boundary effect:
ConvF Y	<b>6.3</b> $\pm 9.5\%$ (k=2)	Alpha <b>0.40</b>
ConvF Z	<b>6.3</b> $\pm 9.5\%$ (k=2)	Depth <b>2.60</b>

Head                      1800 MHz                       $\epsilon_r = 40.0 \pm 5\%$                        $\sigma = 1.40 \pm 5\%$  mho/m

Valid for f=1710-1910 MHz with Head Tissue Simulating Liquid according to EN 50361, P1 528-200X

ConvF X	<b>5.3</b> $\pm 9.5\%$ (k=2)	Boundary effect:
ConvF Y	<b>5.3</b> $\pm 9.5\%$ (k=2)	Alpha <b>0.52</b>
ConvF Z	<b>5.3</b> $\pm 9.5\%$ (k=2)	Depth <b>2.54</b>

### Boundary Effect

Head                      900 MHz                      Typical SAR gradient: 5 % per mm

Probe Tip to Boundary		<b>1 mm</b>	<b>2 mm</b>
SAR <sub>be</sub> [%]	Without Correction Algorithm	11.1	6.4
SAR <sub>be</sub> [%]	With Correction Algorithm	0.3	0.6

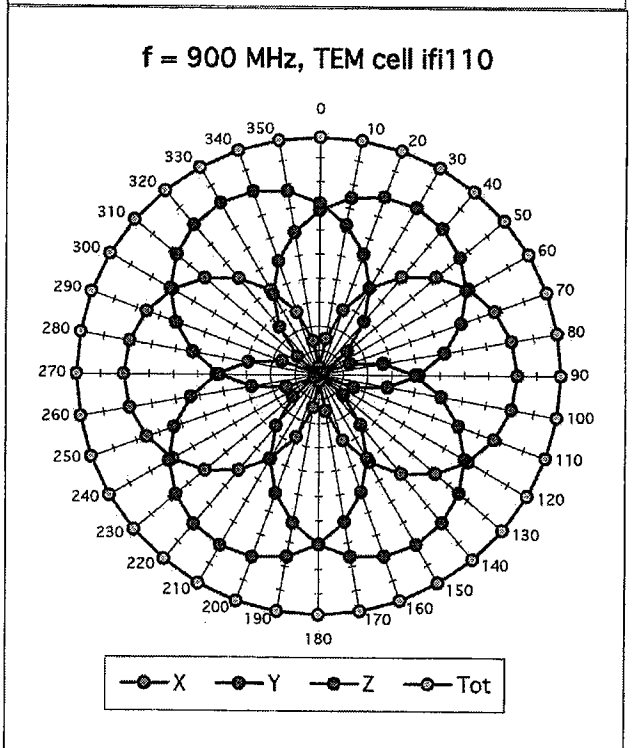
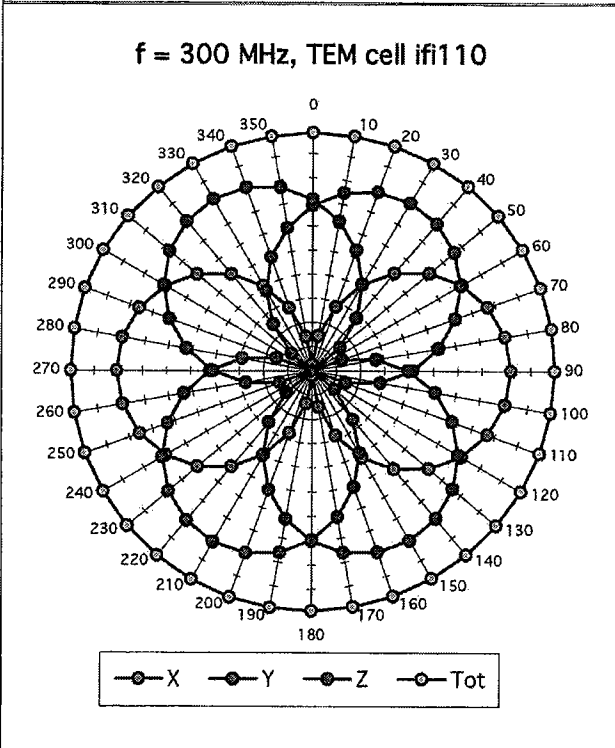
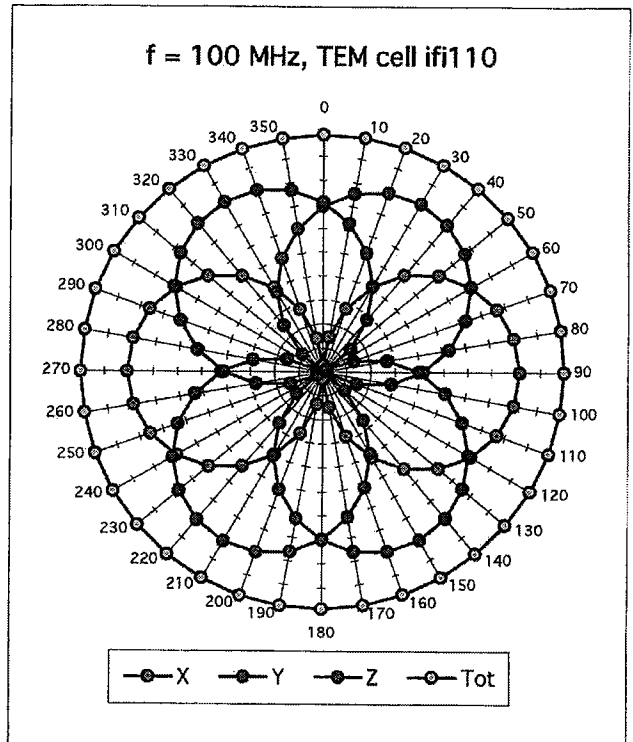
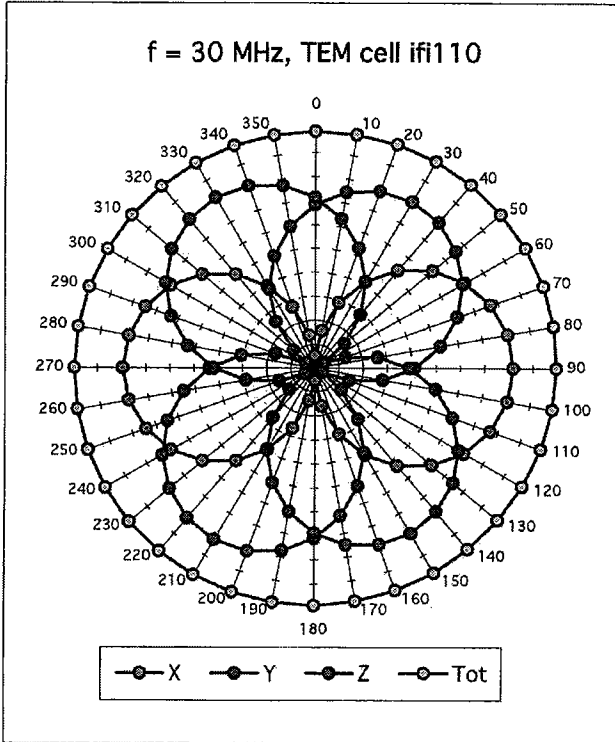
Head                      1800 MHz                      Typical SAR gradient: 10 % per mm

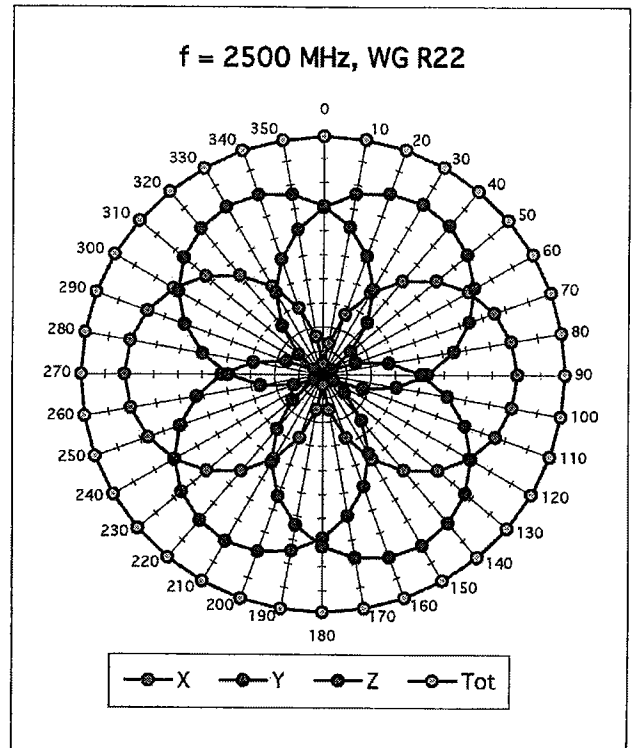
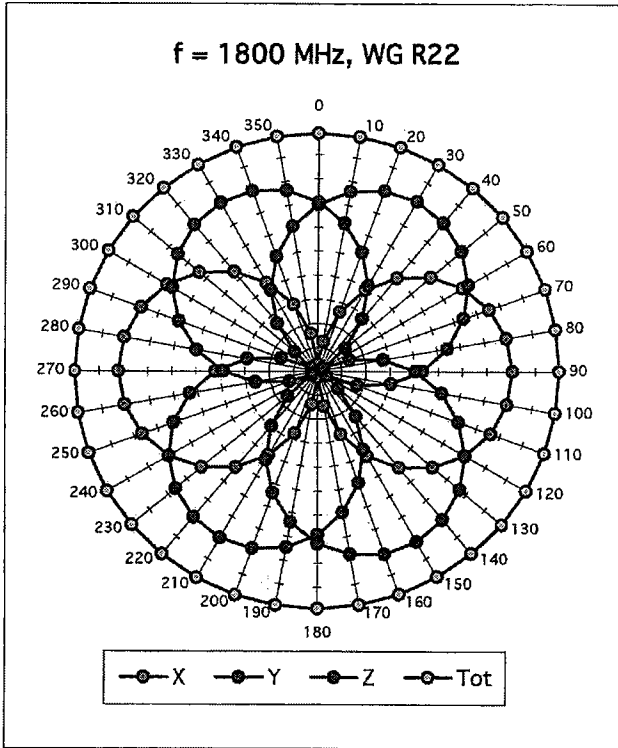
Probe Tip to Boundary		<b>1 mm</b>	<b>2 mm</b>
SAR <sub>be</sub> [%]	Without Correction Algorithm	13.5	9.0
SAR <sub>be</sub> [%]	With Correction Algorithm	0.2	0.1

### Sensor Offset

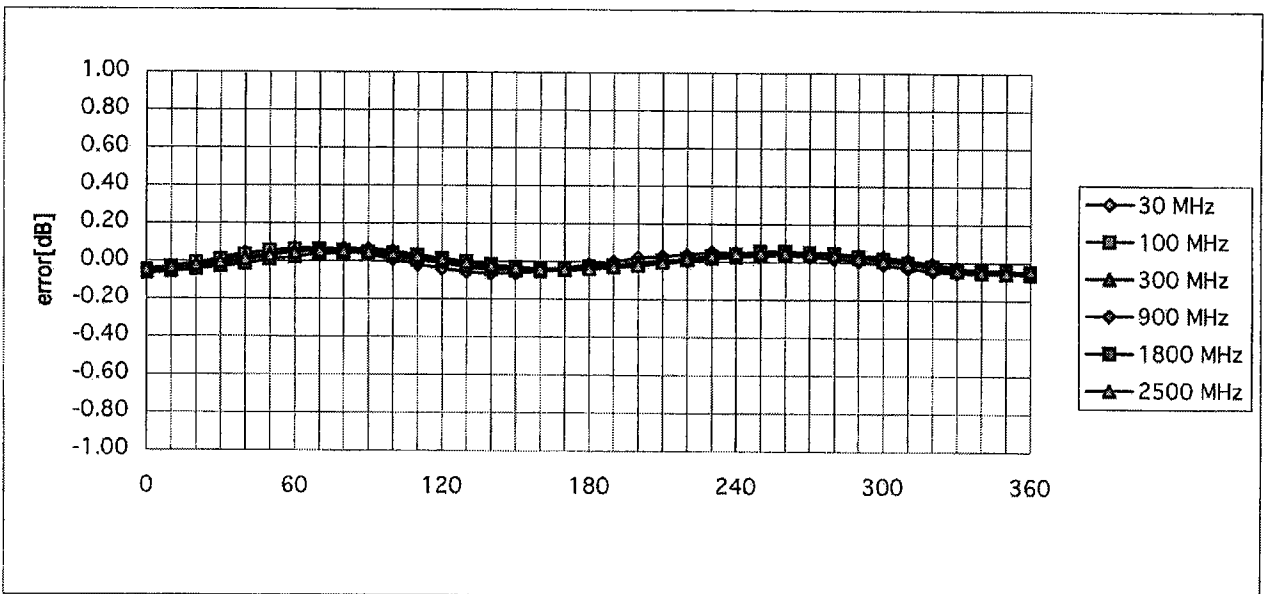
Probe Tip to Sensor Center	<b>2.7</b>	mm
Optical Surface Detection	<b>1.4 <math>\pm</math> 0.2</b>	mm

### Receiving Pattern ( $\phi$ ), $\theta = 0^\circ$



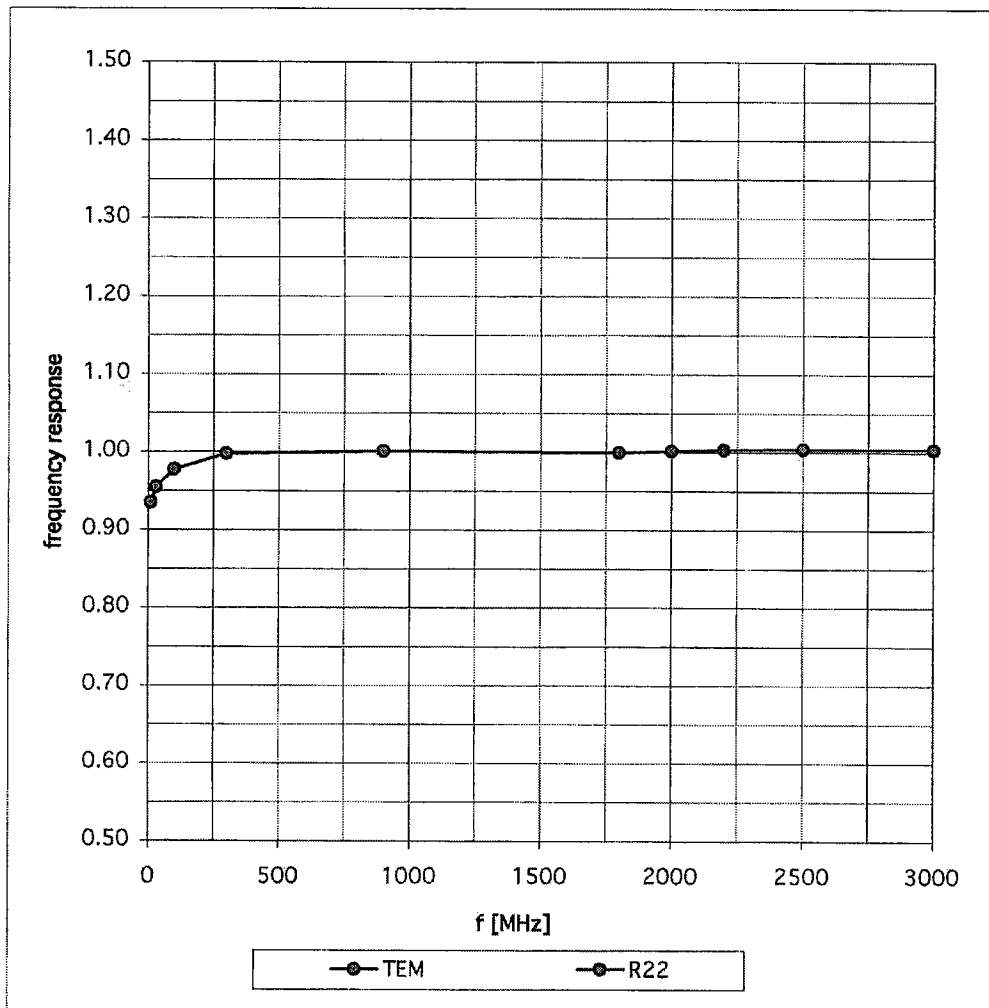


### Isotropy Error ( $\phi$ ), $\theta = 0^\circ$

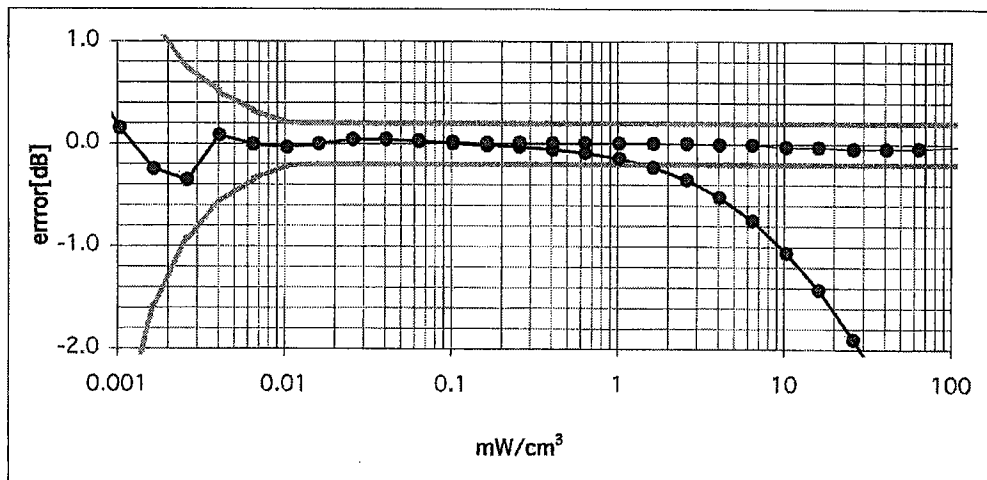
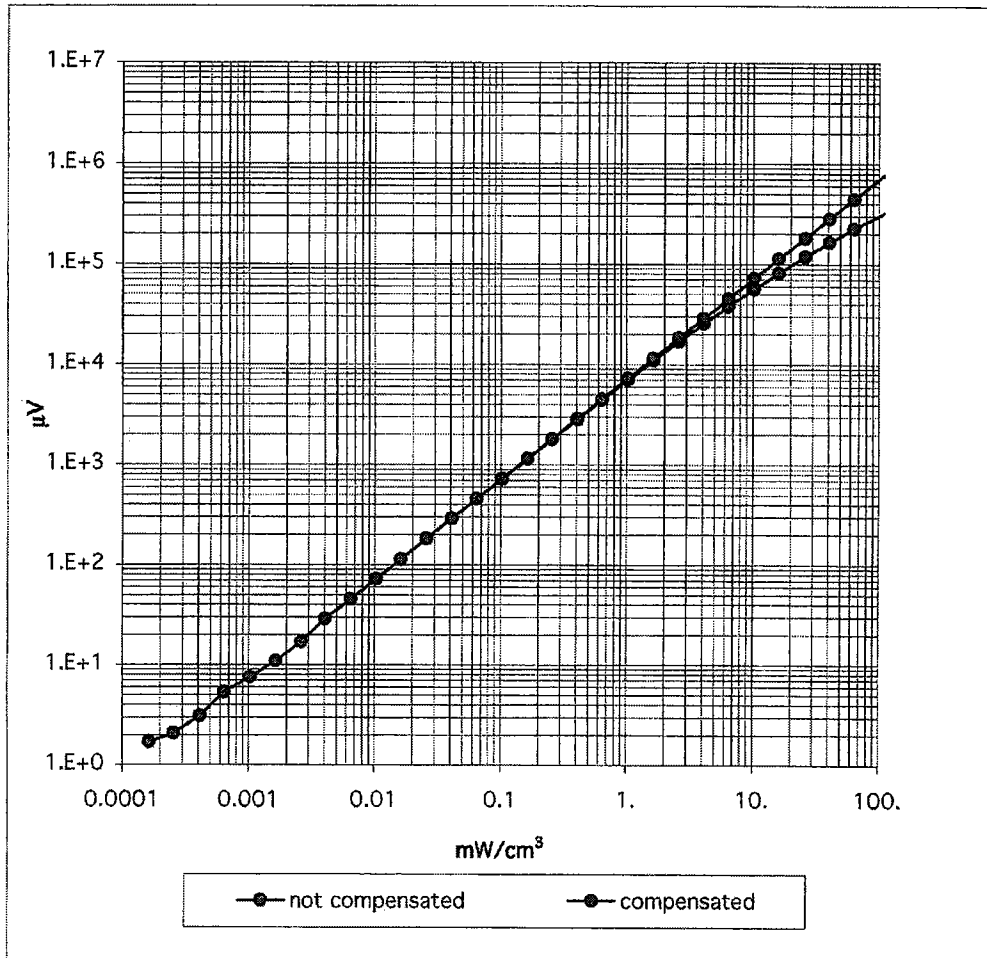


# Frequency Response of E-Field

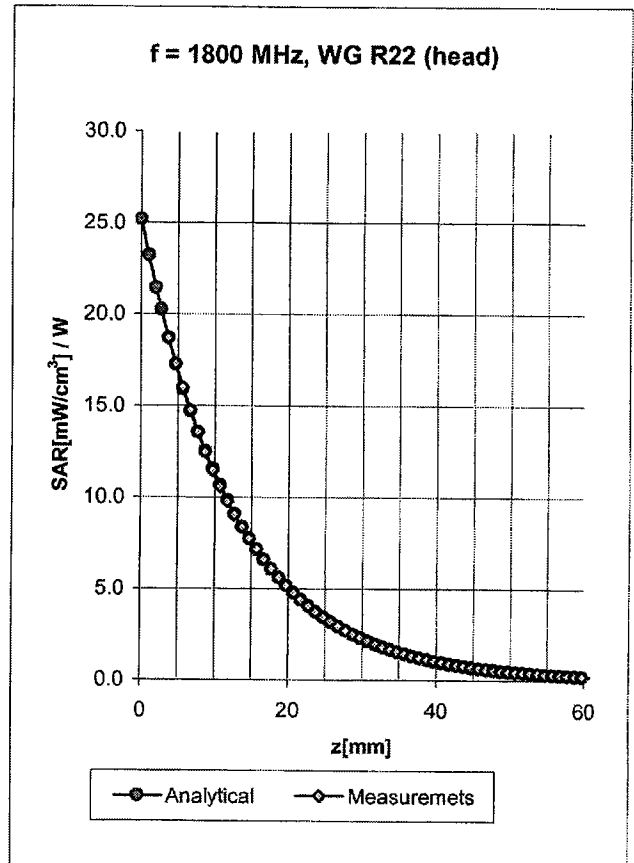
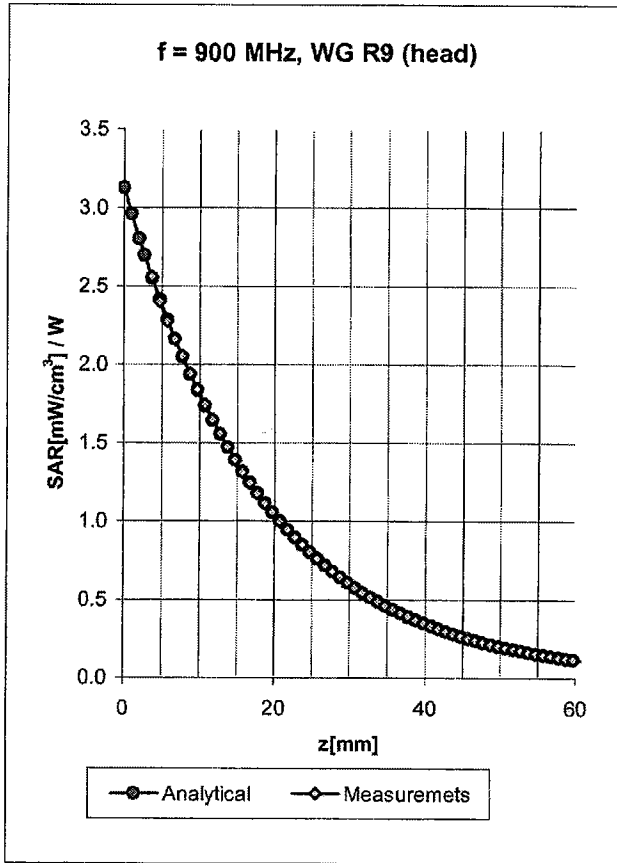
( TEM-Cell:ifi110, Waveguide R22)



### Dynamic Range f(SARhead) ( Waveguide R22 )



### Conversion Factor Assessment



Head                      900 MHz                       $\epsilon_r = 41.5 \pm 5\%$                        $\sigma = 0.97 \pm 5\%$  mho/m

Valid for f=800-1000 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	<b>6.3</b> $\pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	<b>6.3</b> $\pm 9.5\%$ (k=2)	Alpha	<b>0.40</b>
ConvF Z	<b>6.3</b> $\pm 9.5\%$ (k=2)	Depth	<b>2.60</b>

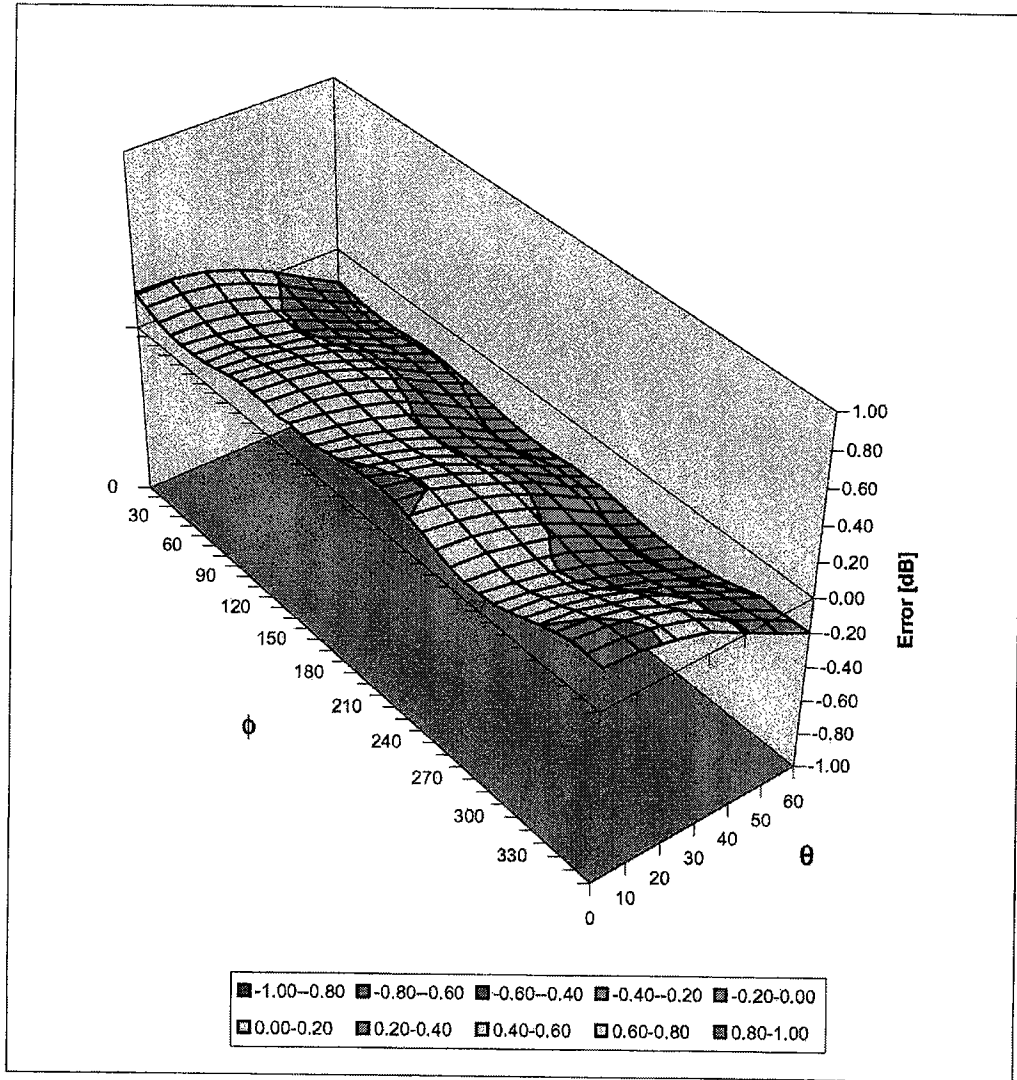
Head                      1800 MHz                       $\epsilon_r = 40.0 \pm 5\%$                        $\sigma = 1.40 \pm 5\%$  mho/m

Valid for f=1710-1910 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	<b>5.3</b> $\pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	<b>5.3</b> $\pm 9.5\%$ (k=2)	Alpha	<b>0.52</b>
ConvF Z	<b>5.3</b> $\pm 9.5\%$ (k=2)	Depth	<b>2.54</b>

# Deviation from Isotropy in HSL

Error ( $\theta, \phi$ ),  $f = 900$  MHz



## Additional Conversion Factors for Dosimetric E-Field Probe

Type:

**ET3DV6**

Serial Number:

**1617**

Place of Assessment:

**Zurich**

Date of Assessment:

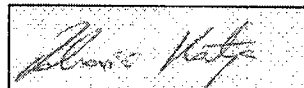
**October 6, 2003**

Probe Calibration Date:

**September 18, 2003**

Schmid & Partner Engineering AG hereby certifies that conversion factor(s) of this probe have been evaluated on the date indicated above. The assessment was performed using the FDTD numerical code SEMCAD of Schmid & Partner Engineering AG. Since the evaluation is coupled with measured conversion factors, it has to be recalculated yearly, i.e., following the re-calibration schedule of the probe. The uncertainty of the numerical assessment is based on the extrapolation from measured value at 900 MHz or at 1800 MHz.

Assessed by:



## Dosimetric E-Field Probe ET3DV6 SN:1617

Conversion factor ( $\pm$  standard deviation)

835 MHz	ConvF	6.2 $\pm$ 8%	$\epsilon_r = 55.2 \pm 5\%$ $\sigma = 0.97 \pm 5\%$ mho/m (body tissue)
1900 MHz	ConvF	4.7 $\pm$ 8%	$\epsilon_r = 53.3 \pm 5\%$ $\sigma = 1.52 \pm 5\%$ mho/m (body tissue)